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POWER LAW DISTRIBUTION AND SELF-ORGANIZED CRITICALITY OF DISPERSED PARTICLES

Degang Ma and Lihe Chai* Font: **Arial**; Size: **12 pt**; Style: **Regular**

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Abstract Research on particulate characteristics has been an important frontier in physics and chemistry during the past decades. It has however been mostly focused on granular materials with short-range interactions. In this work, it was found that the power law of particle size distribution applied to the long-range interacting system of floating dust in air, from which we deduced that self-organized criticality might hold for floating dust just as granular materials with short-range interactions.

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Keywords dispersed particle, floating dust, self-organized criticality, power law

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3. Experimental Results and Discussions

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3.1 Natural size distribution of floating dust

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Table 1 shows the results of test No.1 for three different time periods, indicating but few particles with diameters larger than 10 μm. Fig. 2 is a log-log plot of cumulative particles size distribution for floating dust in air without filtration. The slope of a trend-line is equal to index D, and its error deviation is listed as R^2 in Table 1. The relation between the cumulative particle number and the particle diameter can be represented by the following equation:

Table 1 Cumulative number of dust particles of different sizes Font: **Arial**; Size: **7.5 pt**; Style: **Regular**

No.		Air velocity/(m·s^{-1})	Cumulative particle number N						Index D	Deviation R^2
			0.3 μm	0.5 μm	1.0 μm	3.0 μm	5.0 μm	10 μm		
No.1	1	1.5	2611335	1410251	140810	4792	1954	399	2.65	0.992
	2	1.5	2611113	1195751	77696	3258	1809	506	2.63	0.986
	3	1.5	2247398	851293	96933	4207	568	104	2.94	0.997
No.2	0	1.2	2247398	851293	96933	4207	568	104	2.94	0.997
	1	1.2	485583	65606	2631	124	18	3	3.42	0.992
	2	2.3	1062821	172033	5818	93	9	1	4.04	0.998
No.3	0	1.5	2611113	1195751	77696	3258	1809	506	2.63	0.986
	1	1.5	2611526	1174198	53908	728	348	81	2.99	0.974
	2	2.8	2506590	947778	40074	342	108	28	3.16	0.981

$$\lg N(d_p) = -D \lg d_p + \lg C \,, \quad (1)$$

where d_p is diameter of floating dust (μm); $N(d_p)$, the cumulative number of particles with diameters $> d_p$; C, a constant representing the intercept; and D, the index. Alternately, Eq. (1) can be written as

$$N(d_p) = C d_p^{-D} \,. \quad (2)$$

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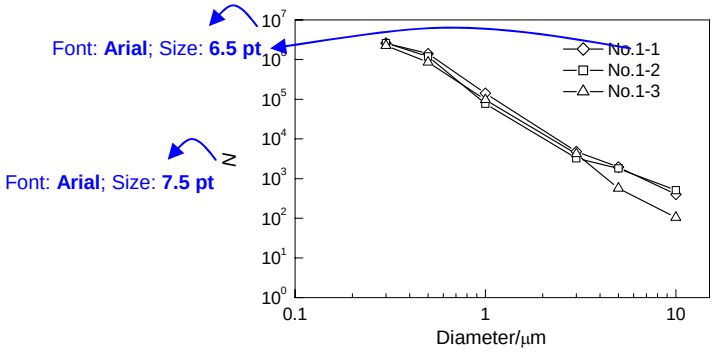

Fig. 2 Natural particle size distribution of floating dust in air. Font: **Arial**; Size: **7.5 pt**; Style: **Regular**

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